SECOND EDITION

The Pennsylvania State College Correspondence Courses in Nature Study

QH 53
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no. 5
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Insect Life

LESSON NO. 5

THE SPIDER

By GEORGE C. BUTZ

OUR text on this occasion is spiders. It will afford a little digression from our regular study of *insects*, for the spider is not an insect. That should not surprise you, for we learned not long ago that the honey-bee is a typical insect, having two pairs of wings, three pairs of legs, a pair of compound eyes and a body divided into three parts—head, thorax and abdomen. Now let us apply this test to the spider before us and see if we should call it an insect.

1. There are no wings. Did you ever see a spider with wings? No.

2. Instead of three pairs of legs, we find four pairs of jointed legs. (See Fig. 16.) Now, that number is never found in insects. Some larvæ, or caterpillars, have eight pairs of legs, but we have seen that five pairs in such cases are fleshy false legs, that disappear when the larvæ go into the next stage of their existence.

3. We do not see the pair of compound eyes in the spider, but if we have a large spider and a magnifying glass we may see several small eyes set firmly in the head arranged in two rows across the forehead. There are usually eight of them, sometimes six, rarely four, and in a few cases only two. It is said, also, that certain spiders which dwell in dark caves are blind, having only rudimentary eyes.

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4. The body of a spider is divided into two parts only —the head and thorax are combined into a solid piece, to which are attached all the legs, the mouth parts and eyes. The abdomen is present often as a large, round sack, plump and nicely colored. It is not distinctly marked with rings, as in the insects, and bears on the under side the spinnerets, from which the spider's silk thread is drawn. Furthermore, the spider has no antennæ, as in insects. We may see, however, in their place a pair of leg-like appendages which are used by the spider to grasp its prey. Then, if we have watched spiders at all, we know that the young hatched from the eggs resemble the adults except in size, and do not pass through the larval or pupal stage.

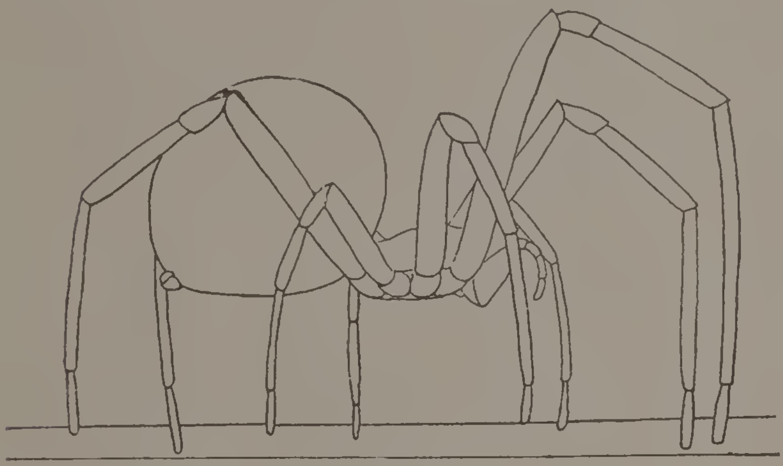

Fig. 16. A common house spider.
Enlarged. (After Emerton.)

It is clear, then, that the spider must not be called an insect. But what shall we call it? Some naturalists have regarded the spider as a degraded insect, having lost its wings and the movement of its head. Others have pointed to the great intelligence displayed by spiders, and placed them above the insects. But it is not for us to enter into such questions. Let us see what other animals may be considered as belonging to the same class as spiders, such as have four pairs of jointed legs and no wings. We all know the daddy-long-legs, or harvest men, the scorpions and mites. There is no name commonly used that would include these related animals, and we will reserve the scientific name for older pupils. It is true that spiders are closely related to insects, and if we are not permitted to call them *insects*, we will simply call them *spiders*, for there are enough of them to make a whole class. There are trap-door spiders, crab spiders, running spiders, jumping spiders, garden spiders, house spiders, water spiders, and so on. The name *spider* means a *spinner*. The most remarkable fact about spiders, to distinguish them from other animals, is their habit of spinning a silken thread and weaving it into variously shaped traps in which to conceal themselves and to catch their prey.

Spiders are carnivorous; that is, they feed on animal food —principally insects. In this respect, they are largely different from insects, because insects usually feed upon vegetable materials. How often have we heard or said, "'Will you walk into my parlor,' said the spider to the fly?" We may have amused ourselves by sitting beside a fresh spider web, and have seen a fly or other insect dart into the web, become entangled, and the spider make its sudden appearance, seizing the fly and receding with its game into the hiding-place, to sap out its life blood. It is commonly known that spiders feed upon insects, their near relatives, but it is not so generally known that some insects live on spiders. You have seen balls of mud placed against the rafters of barns. If you take one down, you will find that it has cells within filled with spiders apparently dead. This ball of mud is the nest of a wasp which feeds its young larvæ with "preserved" spiders. When a cell is constructed, an egg is laid in it, and small spiders are caught by the wasp and stung to paralyze them, then packed into the mud cell and sealed for the young larval wasp to feed upon after it is hatched. The paralyzed spiders do not decay, but are preserved until the wasp larva is ready to eat it.

The *bird-spider* is a large hairy spider of tropical America, which is strong enough to attack, and has a poison capable of killing, small birds. On the other hand, in India there is a bird called the *spider-eater*, that feeds upon spiders. Again, there are so-called *crab-spiders*, which resemble crabs in having the two front pairs of legs much longer than the rest—and some of them, like the crab, can walk sidewise better than forward. These spiders make no webs, but seize their prey by suddenly dropping upon them. It is interesting to note here that there are crabs known as *spider-crabs* because of their resemblance to spiders. They are called also *sea-spiders*, having legs long and slender, making the animal look like a great spider in the water.

Several insects, because of their spider-like appearance, are named the *spider-ant*, the *spider-bug* and *spider-fly*. There is also a *spider-monkey* in Central America, having slender legs and a long tail, which affords it the means of passing rapidly through the tops of trees. You have heard of very minute *red spiders* on plants in houses. These are not true spiders, but tiny mites. They spin a delicate web. and multiply rapidly on plants.

Now, let us return to our spiders. We do not like them one bit. Their cobwebs in our houses keep us brushing every day, or tell of our careless habits. The spiders go about so quietly that we have no warning of their mischievous work, and if one should suddenly fasten upon us we are frightened, and hate it as we hate a snake. We are told their bite is poisonous, and it is, in a degree; but so far as spiders in Pennsylvania are concerned, it is not likely that any one of them has ever bitten a person, except in defense. Many stings and pimples found on children in the morning are said to have been caused by spiders in the night. This is seldom the case, however. Spiders never bite, if not disturbed, except for the purpose of obtaining food, but when cornered all species will show fight and bite if they can. So will other animals. One naturalist allowed spiders to bite his hand. On the ends of the fingers the skin was too thick, but between the fingers they easily pricked it. The bite swelled and smarted for a quarter of an hour and then itched for a day, as will a mosquito bite. There is a large black spider found in New Zealand, whose bite is very dangerous and sometimes fatal, it is said, even to men. Various insects have been subjected to the bites of spiders and found to die after a few hours, but the same kind of insects, when pricked with needles, have died also from the injury thus inflicted. It would seem, therefore, that the poison of spiders is not very powerful, and our fear of spider bites has but little foundation. The tarantula, a South European spider, has been supposed to cause epilepsy by its bite, which could be relieved only by music of particular kinds. Such stories, of course, are all nonsense, for it is well known today that the tarantula bite produces no effect. In California many people will not raise boards or large stones from the ground with bare hands, for fear of tarantulas lurking underneath. Sometimes large spiders come from tropical countries on bunches of bananas, and create much foolish excitement.

To show that spiders are not savage, a certain naturalist kept one and taught it to take flies from his finger without biting him. Emerton, in his interesting book on spiders, tells that many species may be taught to take food from the hand, or a pair of forceps, or take water from a brush.

The biting apparatus of a spider consists of a pair of mandibles and a pair of maxillæ or jaws. The mandibles are the pair of strong-grasping organs hanging out in front of the head. The sharp claw at the tip is usually folded under when not in use. There is a small opening at the point of this claw, from which the poison flows when an animal is bitten. (See Fig. 18.) From the mandibles the food is passed to the jaws, which hang behind the mandibles, and the blood of the victim is sucked out until nothing but a dry wad is left, and is cast aside. The pair of leg-like parts which project forward from the head like a fifth pair of legs, are called palpi, and are attached to the maxillæ. They serve as feelers, and are six-jointed.

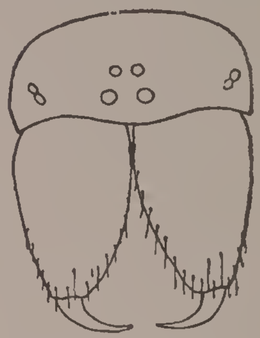

Fig. 17. Head and mandibles of a spider. Enlarged. (After Emerton).

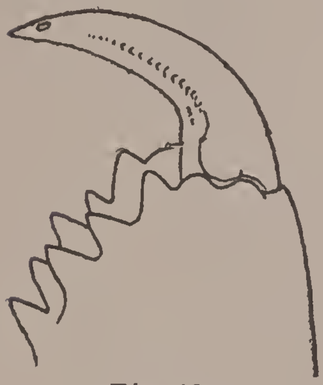

Fig. 18.
Mandible and claw.
Enlarged.
(After Emerton.)

It is interesting to watch spiders spinning their webs. You have already seen that the thread comes from the short, fleshy appendages under the abdomen, which are called the spinnerets. There are two, four or six of them in different spiders. Sometimes one pair is very long and projects from behind like two tails. Each spinneret has on its end a large number of minute tubes. The material forming the web is a fluid within the body which hardens as soon as it is exposed to the air. It streams from each of the spinnerets in many fine fibers, according to the number of tubes — in some species a thousand — and then all unite from the six spinnerets, forming a single thread. If the spider wishes to fasten a thread to any object, it simply presses the spinnerets against it and forces out enough of the silk to adhere; then it moves off and the thread is drawn out. If we have a large spider and can take the thread as it leaves the body, drawing it somewhat rapidly, we may easily see the six or four threads, separated just where they leave the spinnerets. The spider can, how-

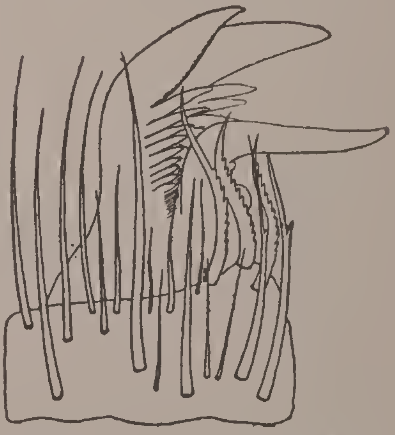

Fig. 19. Foot of spider. Enlarged. (After Emerton.)

ever, press the spinnerets close together, so that but one thread appears as it leaves them. The spinning is often aided by the hinder pair of legs, either to guide the thread or pull it from the spinnerets. We may often see spiders walking along with six legs, using the last pair to draw out a thread as they go. The long waving threads which catch our faces in the fall of the year as we pass along fences or among trees, are drawn out in this manner by the spiders for no apparent purpose.

Spiders are said to fly, but, of course, possessing no wings, this is impossible. They do, however, throw out large quantities of their silk, until there is a sufficient quantity to float their bodies in a gentle wind, and in this manner they are carried through the air. The young of many spiders do this as a youthful sport, and are often carried high in the air. This mostly occurs in September. They may descend from a high position by letting themselves down on their threads, being able to control their speed and to stop the flow of the thread at any time.

The silk of spiders has been woven into textile fabrics. It has been proposed by Professor Wilder that spiders could be raised in large numbers, fed in confinement, and milked each day for their thread. In this way, it is thought an ounce of thread could be gotten from each spider in a summer, and as each cocoon of eggs of the spider he intended to use contains from 500 to 1,000 eggs, it would be possible to obtain a sufficient quantity of thread in a season to manufacture some cloth. The thread is smoother and finer than that of the silkworm. A single thread is used sometimes in the manufacture of delicate astronomical instruments, where a light, fine line is desired. Cobweb is a well-known application for stopping the flow of blood.

There is a remarkable difference in the size of male and female, sometimes being as great as one to ten; that is, the female may be ten times as large as the male of the same species. Stories are told that the female spiders regularly eat the males. Such stories are untrue, but have their foundation in the fact that the females are nearly always much larger than the males and do not allow them in their nests. Fighting between the sexes is common, and the males frequently lose their lives in these encounters. When the female is about to lay eggs (which occurs but once each year, generally in the month of June), she makes a little web and deposits the eggs upon it (from 200 to 500), then covers them with silk, making a cocoon in which the young remain some time after they are hatched. The wolf-spiders carry the cocoons of eggs about with them, held by their spinnerets. Other spiders fasten their cocoons in various places. Some stay by them until the young are hatched, in order to bite open the cocoon so that the young may escape. Others forsake the cocoon at once, leaving the young to get out themselves. They often devour each other before they can escape from their prison.

When the young are released, they moult, casting off the skin, and spin a little web in which they live in common for awhile. The young of running spiders get on the backs of their mothers and are carried about for some time. Spiders moult frequently during their growth. In one case, a spider that lived several years moulted nine times. Many kinds of spiders live only one year, others requiring two years to complete their growth.

The cobwebs are made in a variety of ways, sometimes without any regular shape or design, something like an entanglement about a branch, or in the corner of a room. Sometimes there is an attachment of a cylindrical hall-way, receding into a dark crevice, in which the spider conceals itself. Some spiders dig burrows in the ground, lining them thickly with cobweb and, in the case of the trap-door spiders, protecting the entrance by a neat-fitting lid that works nicely upon a hinge of web.

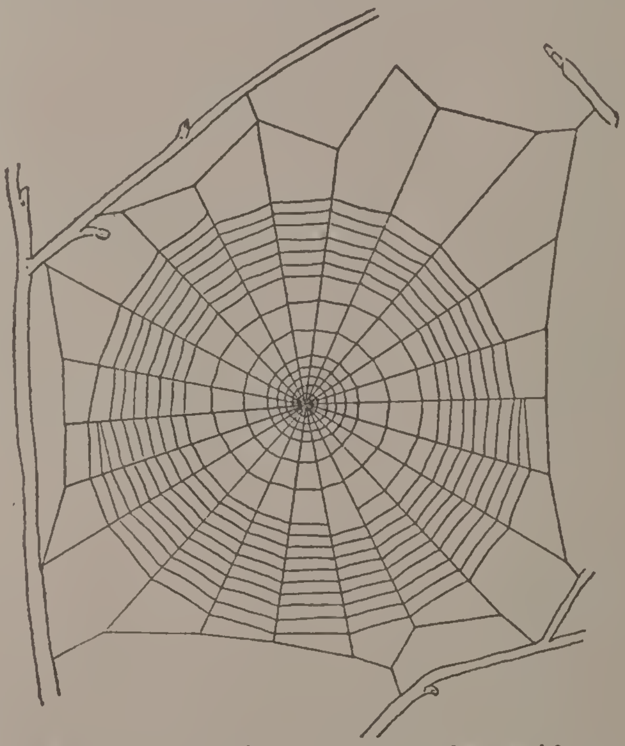
Fig. 20. Web of common garden spider.

The nest which is most attractive and interesting to us is that made by the common garden spider by running the threads to a common center in a single plane, like the spokes of a wheel. (See Fig. 20.) After this frame-work is constructed, the spider begins at the center and fastens a thread from one radiating line to the next in a continuous course, passing about the center, making the turns as far apart as the spider can reach. When the spiral has been completed, the spider begins at the outer edge with a new line, going in the reverse direction and toward the center. The threads are now laid down much closer than before, and seem to be of a different character. The first was smooth: the second is covered with a sticky liquid, to which objects adhere quickly. As the first line is met in laying the second course, the spider bites it off. There is considerable intelligence displayed in this work, and we may be highly amused in watching the proceeding. The spiders which make such webs run a few long threads to hiding places, and when an insect is caught in the web it is indicated over the connecting lines, when the spider promptly rushes out to secure its victim.

I recently discovered several large black wolf-spiders in a lawn. The only surface indication of their presence was an occasional sharply-cut round hole in the ground. Some were an inch in diameter, and others one-half inch in diameter. The large ones contained females, the small ones males. The burrows were from three to six inches deep, ending in an enlarged chamber, without any visible lining of silk. During the summer a female was seen at the surface holding the cocoon of eggs in her mandibles. Later she was seen with the numerous young clinging to her back, but she quickly descended when approached. In the fall I dug up a female which measured three inches from hind foot to front foot, and placed it in a bottle with a male one and one-half inches long. In less than five minutes the former seized the latter, and in about two hours sucked it dry.

SUGGESTIONS TO THE TEACHER

Spiders may be found at any season of the year. Let the pupils bring any kind, for this lesson treats of them collectively.

Have an empty egg cocoon, if not a full one, to be torn apart.

Carefully follow the course of the spider in constructing the web illustrated in this lesson, having the enlarged drawing upon the blackboard.

Find how many eyes can be seen in each specimen spider. A magnifying glass is indispensable in these studies for the best work.

Draw a web thread from the spinneret. Young spiders are better to work with than old ones.

If the season is favorable, find a good fresh web and its spider near the school house, and go there with the class to make observations and talk about spiders.

Ask the pupils questions about the specimen spider or its web that will require close observation, as, "How many joints in a spider's leg?"

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